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# THE REFORESTATION JOB IN THE LAKE STATES - A NEW ESTIMATE

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To plan a sound reforestation program, it is necessary to have the best possible knowledge of the area in need of planting. Past estimates have set the area in need of reforestation in the Lake States at 20 million,3/ 15 million,4/ 8.8 million,5/ and 3 million acres.6/ None of them were applicable to areas less than a state in size. To get figures more up-to-date and applicable to more local areas, a new estimate7/ was made recently. It shows about 12 1/2 million acres of forest land in the Lake States now in need of reforestation. To describe how this estimate was derived and what sort of program it calls for are the purposes of this paper.

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1/ Maintained at University Farm, St. Paul, Minnesota, in cooperation with the University of Minnesota.
2/ Paper delivered at Ann Arbor, Michigan, April 12, 1946, before the Michigan Academy of Science, Arts, and Letters.
3/ Kittredge, Joseph Jr. Forest planting in the Lake States. U.S.D.A. Dept. Bull. 1497, 87 pp., illus., 1929.
4/ Wales, H. Basil. Forest planting in the Lake States. Jour. Forestry 37:691-694. 1939.
5/ Land Committee. Public works and rural land use. Rept. of Land Comm. to Natl. Res. Plan. Board; pp. 115-118, Sept., 1942.
6/ Cunningham, R. N., and Moser, H. C. Forest areas and timber volumes in the Lake States. Economic Note No. 10, Lake States Forest Experiment Station, 84 pp. (processed) March, 1938.
7/ This estimate was derived from a revision of Forest Survey data brought down to January 1, 1945.

## Areas in Need of Reforestation

Three kinds of areas were considered for reforestation now: (1) deforested areas, (2) "off-site" aspen stands, and (3) understocked seedling, sapling, and pole areas. Only upland areas were included. Forest lands too low in productivity for commercial wood production and those devoted to park purposes, some kinds of wildlife management, or other uses in which timber cutting is prohibited or restricted have been excluded from the estimate. It has been assumed that present commercial forest land will continue to be used primarily for wood production. Plantable areas have been estimated for 13 economic units each containing an average of about 4 million acres of commercial forest land.

### Deforested Areas

Deforested land, which includes all areas less than 10 percent stocked and seedling and sapling areas 10 to 40 percent stocked, often is considered as synonymous with area in need of reforestation. This is not entirely correct, as in the Lake States the 14 million acres of deforested land include some 2 1/2 million acres of lowland and swamp types. These cannot be planted economically by methods known at present. In addition, some of the remaining area will be regenerated naturally. To compensate for this trend, deforested pine areas were reduced by 10 percent, northern hardwood lands by 90 percent, oak and aspen-birch lands by 40 percent, and spruce-fir areas by 50 percent. This left a little over 5 1/2 million acres of deforested land classed as plantable (table 1).

### "Off-site" Aspen Areas

In addition to the deforested land there are about 6 million acres of aspen land (exclusive of deforested areas) which are growing on former pine sites. This "off-site" aspen usually becomes defective before reaching merchantable size in commercial quantities. The land is capable of bearing valuable pine stands, but these can be established only by conversion

Table 1.--Estimated plantable deforested land in Lake States (commercial forest land only).

| State and economic unit | | Original type | | | | | | | | Species to be planted | | | | | | | Ownership | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | White pine | Red pine | Jack pine | Northern hardwoods | Oak | Spruce-fir | Aspen-birch | Total | White pine | Red pine | Jack pine | White spruce | Northern hardwoods | Red oak | Total | Federal | State | County & Mun. | Farmers | Other private |
| | | M acres | | | | | | | | M acres | | | | | | | M acres | | | | |
| **Minnesota** | | | | | | | | | | | | | | | | | | | | | |
| Northeastern | 1 | 16 | 1 | 121 | 5 | 2 | 87 | 334 | 566 | 96 | 132 | 183 | 155 | ... | ... | 566 | 65 | 86 | 198 | 92 | 125 |
| Central pine | 2 | 14 | 20 | 162 | 8 | 7 | 29 | 364 | 604 | 92 | 141 | 245 | 126 | ... | ... | 604 | 76 | 108 | 224 | 170 | 26 |
| Rainy River | 3 | 4 | 4 | 8 | (1/) | ... | 20 | 107 | 143 | 26 | 41 | 32 | 44 | ... | ... | 143 | 3 | 83 | 21 | 10 | 26 |
| Hardwood | 5 | 3 | 2 | 3 | 21 | 116 | (1/) | 176 | 321 | 41 | 94 | 93 | 53 | 20 | 20 | 321 | 0 | 0 | 4 | 317 | 0 |
| Prairie | 6 | 1 | 1 | 1 | 7 | 95 | 1 | 100 | 206 | 26 | 66 | 61 | 28 | 11 | 14 | 206 | 0 | 7 | 7 | 145 | 47 |
| Total state | | 38 | 28 | 295 | 41 | 220 | 137 | 1,081 | 1,840 | 281 | 474 | 614 | 406 | 31 | 34 | 1,840 | 144 | 284 | 454 | 734 | 224 |
| **Wisconsin** | | | | | | | | | | | | | | | | | | | | | |
| Northeastern | 1 | 16 | 10 | 28 | 14 | 11 | 55 | 276 | 410 | 58 | 103 | 97 | 108 | 29 | 15 | 410 | 58 | 19 | 131 | 88 | 114 |
| Northwestern | 2 | 10 | 2 | 95 | 24 | 17 | 55 | 400 | 603 | 77 | 139 | 180 | 143 | 42 | 22 | 603 | 84 | 9 | 256 | 127 | 127 |
| Central | 3 | 24 | 2 | 131 | 26 | 244 | 9 | 389 | 825 | 92 | 230 | 304 | 113 | 42 | 44 | 825 | 1 | 5 | 85 | 567 | 167 |
| Southwestern | 4 | 1 | 1 | 11 | 9 | 262 | ... | 38 | 322 | 33 | 118 | 125 | 13 | 5 | 28 | 322 | 6 | 11 | 47 | 243 | 15 |
| Total state | | 51 | 15 | 265 | 73 | 534 | 119 | 1,103 | 2,160 | 260 | 590 | 706 | 377 | 118 | 109 | 2,160 | 149 | 44 | 519 | 1,025 | 423 |
| **Michigan** | | | | | | | | | | | | | | | | | | | | | |
| Eastern U.P. | 1 | 8 | 4 | 92 | 14 | ... | 55 | 98 | 271 | 34 | 54 | 109 | 63 | 11 | ... | 271 | 81 | 94 | 1 | 49 | 46 |
| Western U.P. | 2 | 15 | 2 | 11 | 21 | ... | 50 | 106 | 205 | 31 | 52 | 39 | 65 | 13 | 5 | 205 | 6 | 44 | 1 | 40 | 114 |
| Northern L.P. | 3 | 3 | 5 | 274 | 16 | 56 | 19 | 475 | 848 | 83 | 179 | 371 | 137 | 49 | 29 | 848 | 10 | 124 | 3 | 366 | 345 |
| Southern L.P. | 4 | 3 | ... | 9 | 14 | 160 | (1/) | 118 | 304 | 57 | 121 | 12 | 57 | 22 | 35 | 304 | 2 | 9 | 1 | 256 | 36 |
| Total state | | 29 | 11 | 386 | 65 | 216 | 124 | 797 | 1,628 | 205 | 406 | 531 | 322 | 95 | 69 | 1,628 | 99 | 271 | 6 | 711 | 541 |
| Total Lake States | | 118 | 54 | 946 | 179 | 970 | 380 | 2,981 | 5,628 | 746 | 1,470 | 1,851 | 1,105 | 244 | 212 | 5,628 | 392 | 599 | 979 | 2,470 | 1,188 |

1/ Less than 0.5.

planting. About half of the "off-site" aspen is in sapling or pole-sized stands, which are too expensive to convert by present methods. This leaves about 3 million acres for conversion planting at present (table 2).

Understocked Seedling, Sapling, and Pole Stands

Beyond the areas requiring complete planting, there are numerous understocked seedling, sapling, and pole stands which need partial planting, or "sweetening" to improve their stocking - and often their composition. These include seedling and sapling stands from 40 to 60 percent stocked and pole stands from 10 to 40 percent stocked. Assuming that northern hardwood and aspen-brich stands of this type will largely improve their stocking by natural means and that lowland and swamp types are not plantable under present knowledge, a total of about 3 3/4 million acres remain for partial planting with perhaps 300-500 trees per acre (table 3).

Species to Plant

Past estimates of the area in need of planting have not gone so far as to show what species were needed, except for one estimate covering northern Wisconsin.[8/] Such information is necessary for the nursery program basic to the planting job. On the basis of general experience, it was estimated that the deforested areas should be planted to the following species according to original cover types:

| Cover type | Species to be planted | | | | | |
|---|---|---|---|---|---|---|
| | White pine | Red pine | Jack pine | White spruce | Northern hardwoods | Red oak |
| | Percent | | | | | |
| White pine | 20 | 60 | 20 | ... | ... | ... |
| Red pine | ... | 40 | 60 | ... | ... | ... |
| Jack pine | ... | 10 | 90 | ... | ... | ... |
| Northern hardwoods | 10 | 20 | 20 | 40 | 10 | ... |
| Oak | 10 | 40 | 40 | ... | ... | 10 |
| Spruce-fir | 20 | 20 | ... | 60 | ... | ... |
| Aspen-birch | 15 | 25 | 20 | 25 | 10 | 5 |

8/ Harrington, C. L., Brener, W. H., and Wilde, S. A. How large is the job of reforestation in Wisconsin Wisc. Cons. Bull. 9(6):6-11, June, 1944.

Table 2.--Estimated planting job in converting "off-site" aspen.

| State and economic unit | | Species to be planted | | | | | | Ownership | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | White pine | Red pine | Jack pine | White spruce | Red oak | Total | Federal | State | County & mun. | Farmers | Other private |
| | | M acres | | | | | | | | | | |
| Minnesota | | | | | | | | | | | | |
| Northeastern | 1 | 50 | 138 | 122 | 4 | ... | 319 | 92 | 41 | 100 | 26 | 60 |
| Central pine | 2 | 100 | 253 | 207 | 5 | ... | 560 | 86 | 125 | 160 | 100 | 89 |
| Rainy River | 3 | 20 | 44 | 34 | 3 | ... | 101 | 6 | 61 | 11 | 7 | 16 |
| Hardwood | 5 | 3 | 6 | 4 | 1 | 1 | 15 | 0 | 0 | (1/) | 15 | (1/) |
| Prairie | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total state | | 173 | 441 | 367 | 13 | 1 | 995 | 184 | 227 | 271 | 148 | 165 |
| Wisconsin | | | | | | | | | | | | |
| Northeastern | 1 | 80 | 143 | 114 | 6 | 28 | 371 | 65 | 20 | 77 | 67 | 142 |
| Northwestern | 2 | 77 | 135 | 108 | 4 | 27 | 351 | 54 | 8 | 108 | 70 | 111 |
| Central | 3 | 46 | 81 | 64 | 2 | 16 | 209 | (1/) | 1 | 16 | 140 | 52 |
| Southwestern | 4 | 0 | (1/) | 1 | 0 | 0 | 1 | (1/) | (1/) | (1/) | 1 | (1/) |
| Total state | | 203 | 359 | 287 | 12 | 71 | 932 | 119 | 29 | 201 | 278 | 305 |
| Michigan | | | | | | | | | | | | |
| Eastern U.P. | 1 | 30 | 69 | 46 | 5 | ... | 150 | 29 | 46 | 1 | 11 | 63 |
| Western U.P. | 2 | 42 | 90 | 63 | 5 | 6 | 206 | 31 | 41 | 1 | 12 | 121 |
| Northern L.P. | 3 | 174 | 293 | 255 | 2 | 39 | 763 | 74 | 208 | 2 | 144 | 335 |
| Southern L.P. | 4 | 12 | 25 | 11 | 0 | 4 | 52 | (1/) | 3 | (1/) | 36 | 13 |
| Total state | | 258 | 477 | 375 | 12 | 49 | 1,171 | 134 | 298 | 4 | 203 | 532 |
| Total Lake States | | 634 | 1,277 | 1,029 | 37 | 121 | 3,098 | 437 | 554 | 476 | 629 | 1,002 |

1/ Less than 0.5.

Table 3.--Understocked seedling and sapling and pole areas in need of partial planting.

| State and economic unit | | Cover type | | | | | | Species to plant | | | | | | Ownership | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | White pine | Red pine | Jack pine | Oak | Spruce-fir | Total | White pine | Red pine | Jack pine | White spruce | Northern hardwoods | Red oak | Federal | State | County & Mun. | Farmers | Other private |
| | | M acres | | | | | | M acres | | | | | | M acres | | | | |
| **Minnesota** | | | | | | | | | | | | | | | | | | |
| Northeastern | 1 | 21 | 17 | 174 | 4 | 263 | 479 | 86 | 175 | 55 | 163 | 0 | 0 | 159 | 56 | 149 | 35 | 80 |
| Central pine | 2 | 21 | 31 | 212 | 21 | 115 | 400 | 48 | 201 | 72 | 79 | 0 | 0 | 70 | 95 | 104 | 54 | 77 |
| Rainy River | 3 | 8 | 12 | 43 | 0 | 131 | 194 | 42 | 56 | 16 | 80 | 0 | 0 | 14 | 121 | 18 | 15 | 26 |
| Hardwood | 5 | 4 | 3 | 3 | 117 | 1 | 128 | 24 | 42 | 14 | 25 | 0 | 23 | 1 | 0 | 7 | 117 | 3 |
| Prairie | 6 | 1 | 1 | (1/) | 73 | 5 | 80 | 16 | 23 | 7 | 18 | 1 | 15 | 1 | 11 | 14 | 37 | 17 |
| Total state | | 55 | 64 | 432 | 215 | 515 | 1,281 | 216 | 497 | 164 | 365 | 1 | 38 | 245 | 283 | 292 | 258 | 203 |
| **Wisconsin** | | | | | | | | | | | | | | | | | | |
| Northeastern | 1 | 25 | 28 | 44 | 53 | 155 | 305 | 49 | 98 | 24 | 93 | 31 | 10 | 60 | 19 | 62 | 50 | 114 |
| Northwestern | 2 | 22 | 24 | 123 | 37 | 149 | 355 | 43 | 142 | 46 | 87 | 30 | 7 | 67 | 10 | 106 | 62 | 110 |
| Central | 3 | 17 | 8 | 94 | 206 | 13 | 338 | 48 | 144 | 51 | 51 | 3 | 41 | 1 | 3 | 25 | 202 | 107 |
| Southwestern | 4 | 6 | 4 | 12 | 306 | 0 | 328 | 62 | 107 | 36 | 62 | 0 | 61 | 8 | 11 | 32 | 262 | 15 |
| Total state | | 70 | 64 | 273 | 602 | 317 | 1,326 | 202 | 491 | 157 | 293 | 64 | 119 | 136 | 43 | 225 | 576 | 346 |
| **Michigan** | | | | | | | | | | | | | | | | | | |
| Eastern U.P. | 1 | 18 | 29 | 94 | 0 | 152 | 293 | 37 | 112 | 34 | 80 | 30 | 0 | 67 | 98 | 1 | 13 | 114 |
| Western U.P. | 2 | 22 | 13 | 27 | 0 | 148 | 210 | 35 | 57 | 11 | 77 | 30 | 0 | 58 | 55 | 1 | 10 | 86 |
| Northern L.P. | 3 | 19 | 49 | 230 | 98 | 71 | 467 | 43 | 242 | 89 | 59 | 14 | 20 | 72 | 144 | 2 | 50 | 199 |
| Southern L.P. | 4 | 10 | 0 | 0 | 116 | 1 | 127 | 25 | 41 | 12 | 26 | 0 | 23 | 2 | 7 | (1/) | 64 | 54 |
| Total state | | 69 | 91 | 351 | 214 | 372 | 1,097 | 140 | 452 | 146 | 242 | 74 | 43 | 199 | 304 | 4 | 137 | 453 |
| Total Lake States | | 194 | 219 | 1,056 | 1,031 | 1,204 | 3,704 | 558 | 1,440 | 467 | 900 | 139 | 200 | 580 | 630 | 521 | 971 | 1,002 |

1/ Less than 0.5.

These percentages were applied to the values in table 1 with certain minor exceptions: in the three northern Minnesota units no areas were recommended for planting to northern hardwoods or red oak - the areas so assigned by the percentage values were distributed among the other species; in the same manner no areas were recommended for planting to red oak in eastern Upper Michigan. The results of these calculations show the estimated area to be planted to the major species (table 1). This amounts to 33 percent jack pine, 26 percent red pine, 20 percent white spruce, 13 percent white pine, 4 percent northern hardwoods, and 4 percent red oak.

The amount of the major species to plant on the "off-site" aspen areas was obtained in the same way, except that no northern hardwoods, only a small amount of spruce, and a reduced amount of red oak were recommended (table 2). The proportions to be planted by species are 41 percent red pine, 33 percent jack pine, 21 percent white pine, 4 percent red oak, and 1 percent white spruce.

The basis for selecting the species to be planted on the understocked areas was a little different from that for the areas needing complete planting. It was as follows:

| Cover type | Species to be planted | | | | | |
|---|---|---|---|---|---|---|
| | White pine | Red pine | Jack pine | White spruce | Northern hardwoods | Red oak |
| | Percent | | | | | |
| White pine | 20 | 60 | ... | 20 | ... | ... |
| Red pine | 10 | 70 | 20 | ... | ... | ... |
| Jack pine | ... | 70 | 30 | ... | ... | ... |
| Oak | 20 | 30 | 10 | 20 | ... | 20 |
| Spruce-fir | 20 | 10 | ... | 50 | 20 | ... |

As with the deforested and "off-site" aspen lands, no area in the three northern Minnesota units was recommended for planting to northern hardwoods or red oak. The acreage recommended for planting to the 6 major

species is divided 39 percent for red pine, 24 percent for white spruce, 15 percent for white pine, 13 percent for jack pine, 5 percent for red oak, and 4 percent for northern hardwoods (table 3).

While local conditions may dictate the use of species other than those listed here or alter the basis for selecting them, these estimates do provide a starting point for large-scale planning.

## Ownership of Plantable Areas

Some measure of the responsibility for a reforestation program is shown by land ownership. Estimates show that federal agencies own 7 percent of the deforested land, 14 percent of the plantable "off-site" aspen land, and 16 percent of the understocked areas; state agencies own 11 percent of the deforested, 18 percent of the "off-site" aspen, and 17 percent of the understocked land; county and municipal agencies own 17 percent of the deforested, 16 percent of the "off-site" aspen, and 14 percent of the understocked land; farmers own 44 percent of the deforested, 20 percent of the "off-site" aspen, and 26 percent of the understocked areas; and other private owners have 32 percent of the deforested, 21 percent of the "off-site" aspen, and 27 percent of the understocked land (tables 1, 2, and 3).

It is clear that the responsibility for reforestation in the Lake States is not entirely a public matter. Private owners have a bigger job confronting them than do public agencies. Of course, tax delinquency will probably convert some of these lands from private to public ownership, and more public aid may have to be provided private owners to stimulate reforestation. The public probably will have to play a role larger than indicated by its ownership.

## A Big Program Needed

To reforest the entire 12 1/2 million acres in the Lake States would be a tremendous program. It could provide about 1 1/4 million man-months of work. Later, release and other care could provide an additional 3/4

million or more man-months of work. At prewar prices such a planting program would cost over 180 million dollars and the after-care needed would cost about 30 million dollars more; present costs would be considerably higher. If such a program were carried out over a 50-year period, it would require the annual planting of 250,000 acres, over 100,000 acres greater than the peak program during the CCC and WPA days. It would also mean the annual production of some 200 million plantable trees in nurseries.

Whether or not the complete program will ever be undertaken is uncertain. Some factors, other than economic or political ones, which might tend to reduce it are: (1) More rapid natural regeneration than past experience indicates, (2) greater shifts of plantable forest land to parks, recreational areas, wildlife areas, or uses other than wood production, and (3) new uses for small and defective aspen on "off-site" lands. There are also some factors which might increase the program, such as (1) increased forest fires and destructive cutting, (2) workable methods of reforesting lowland and swamp lands, and (3) later conversion planting on the 3 million acres of sapling and pole-sized off-site aspen.

If even half of the program mentioned here is undertaken, it will still be a huge one. These estimates can serve a useful point from which to start planning either the full or a reduced program.